

# **Vaccines and Autism: A Resource Kit**

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## **CDC: Vaccines and Autism**

Our agency's mission is to prevent disease, disability, and death. We're committed to identifying health problems, finding their causes, and working on ways to prevent or treat them. Many of our efforts, including those involving immunization, are first and foremost devoted to promoting the health of children.

Autism is a serious, life-long, developmental disability. We support efforts to find and prevent all the causes of autism as rapidly as possible.

The currently available scientific evidence does not support the hypothesis that vaccines cause autism. We recognize there is considerable parent interest in this issue, and therefore support additional research regarding this hypothesis. We are doing so because we are committed to ensuring the safest immunization program possible.

There is much evidence of the benefits of childhood immunization, including record, or near record, low rates of vaccine preventable diseases in the United States. Last year, for example, there were fewer than 100 reported cases of measles—and no deaths—in the US, compared with 27,786 cases and 64 deaths in 1990.

Thus, one of the most effective ways that parents can protect the health of their children—especially infants and young children—is to ensure that the children receive all of their recommended immunizations on time.

*April 5, 2000*

## **The Importance of Childhood Immunizations**

Disease prevention is the key to public health. It is always better to prevent a disease than to treat it. Vaccines prevent disease in the people who receive them and protect those who come into contact with unvaccinated individuals. Vaccines help prevent infectious diseases and save lives. Vaccines are responsible for the control of many infectious diseases that were once common in this country, including polio, measles, diphtheria, pertussis (whooping cough), rubella (German measles), mumps, tetanus, and *Haemophilus influenzae* type b (Hib).

Parents are constantly concerned about the health and safety of their children and take many steps to protect them. These steps range from child-proof door latches to child safety seats. In the same way, vaccines work to protect infants, children, and adults from illnesses and death caused by infectious diseases. While the US currently has record, or near record, low cases of vaccine-preventable diseases, the viruses and bacteria that cause them still exist. Even diseases that have been eliminated in this country, such as polio, are only a plane ride away. Polio, and other infectious diseases, can be passed on to people who are not protected by vaccines.

Vaccine-preventable diseases have a costly impact, resulting in doctor's visits, hospitalizations, and premature deaths. Sick children can also cause parents to lose time from work.

### **Why Are Childhood Vaccines So Important?**

- ! It's true that newborn babies are immune to many diseases because they have antibodies they got from their mothers. However, the duration of this immunity may last only a month to about a year. Further, young children do not have maternal immunity against some vaccine-preventable diseases, such as whooping cough.
- ! If a child is not vaccinated and is exposed to a disease germ, the child's body may not be strong enough to fight the disease. Before vaccines, many children died of diseases vaccines now prevent, such as whooping cough, measles, and polio. Those same germs exist today, but babies are now protected by vaccines, so we do not see these diseases as often.
- ! Immunizing individual children also helps to protect the health of our community, especially those people who are not immunized. People who are not immunized include those who are too young to be vaccinated (e.g., children less than a year old cannot receive the measles vaccine but can be infected by the measles virus), those who cannot be vaccinated for medical reasons (e.g., children with leukemia), and those who cannot make an adequate response to vaccination. Also protected, therefore, are people who received a vaccine, but who have not developed immunity. In addition, people who are sick will be less likely to be exposed to disease germs that can be passed around by unvaccinated children. Immunization also slows

down or stops disease outbreaks.

## **Facts About Autism**

### **What is autism?**

Autism is a complex, life-long, developmental disability manifested by social interaction problems, communication difficulties, and restrictive or repetitive interests and behaviors. It is estimated that about 1 in 1000 children have autism. Also, as many as 2-5 per 1000 children may exhibit some form of the disorder. Developmental disabilities are a diverse group of physical, cognitive, psychological, sensory and speech impairments that are usually identified between birth and up to age 18 years. It is estimated that about 17 percent of all children have a developmental disability, and 2 percent have a serious developmental disability such as mental retardation, cerebral palsy or autism.

Parents and expert clinicians can often detect symptoms during infancy, although a formal diagnosis is generally not made until the child fails to develop functional language by age two. There are several standard testing instruments that are available to diagnose children by age three. It has been reported that approximately 20 percent of children with autism experience a “regression;” that is, they have apparently normal development followed by a loss of communication and social skills. These changes are often difficult to verify without knowing the functional status of children before a diagnosis of autism is made.

Boys are three-to-four times more likely to have autism than girls. Autism occurs in all racial, ethnic, and social groups.

Although there is currently no known cure for autism, some aspects of the condition are treatable. People with autism can make progress if they receive appropriate, individual intervention. Pre-school children who receive intensive, individualized, behavioral interventions show good progress. In addition, limited pharmacological interventions are available to treat symptoms associated with autism.

### **What causes autism?**

A variety of factors could be associated with some forms of autism, including infectious, metabolic, genetic, neurological, and environmental factors. CDC believes that the current scientific evidence does not support the hypothesis that the measles-mumps-rubella (MMR) vaccine, or any combination of vaccines, causes the development of autism, including regressive forms of autism.

Genetic factors and brain abnormalities at birth are considered to be some of the most recognized causes of autism. In 1995, a working group convened by the National Institutes of Health (NIH) reached a consensus that autism probably results from a genetic susceptibility that involves multiple

genes. It is also known that exposure to thalidomide before birth and congenital rubella syndrome (CRS) can cause autism. CRS is a syndrome of multiple birth defects that occurs when a pregnant woman is infested with “wild” rubella virus during the early part of pregnancy.

To date, genetic causes for one disorder commonly accompanying autism and one autism-spectrum disorder have been identified—Fragile X and Rett’s Disorder, respectively. Also, several abnormal areas on various chromosomes for more classic autism have been found. Fragile X is the most common genetically inherited form of mental retardation currently known and produces many of the same behaviors and symptoms as autism. Rett Syndrome, which affects only girls, is a progressive brain disease that produces a loss of language/social skills that is similar to autism.

NIH research on possible genetic, infectious, immunological, neurological, and environmental causes and mechanisms of autism is underway.

### **Sources for Information**

- ! The CDC’s Division of Birth Defects, Child Development, and Disability and Health provides information about autism through their toll-free health line at 1-800-232-6789 and on their web site, at <http://www.cdc.gov/nceh/programs/cddh/dd/ddautism.htm>
- ! For more information on autism and autism research, contact the National Institute of Child Health and Human Development (NICHD) Clearinghouse, at 1-800-370-2943, or visit the NICHD web site at <http://www.nichd.nih.gov/publications/pubs/autism1.htm>
- ! For more information on vaccines and vaccine safety, contact the National Immunization Program (NIP) at 1-800-232-2522 (English) or 1-800-232-0233 (Spanish), or visit the NIP web site at <http://www.cdc.gov/nip>

## Vaccines and Autism

Recently, there has been some public interest in a theory that suggests the measles-mumps-rubella (MMR) vaccine, or that immunizations in general, may be linked to autism. CDC believes that the current scientific evidence does not support the hypothesis that MMR, or any combination of vaccines, cause the development of autism.

### The Initial Hypothesis

An initial observation linking autism and MMR vaccine was reported by Dr. Andrew Wakefield of the Royal Free Hospital in the United Kingdom. Dr. Wakefield and his colleagues first attempted to link measles disease and vaccination to bowel diseases such as Crohn's Disease. Dr. Wakefield suggested that MMR vaccination led to intestinal abnormalities, resulting in impaired intestinal function and developmental regression within 24 hours to a few weeks of vaccination. This hypothesis, which suggested that children experienced developmental regression shortly after receipt of MMR vaccine, was based on 12 children.

### Scientific Evidence Regarding Vaccines and Autism

CDC believes that the current scientific evidence does not support the hypothesis that the MMR vaccine, or any combination of vaccines, causes the development of autism. The research that supports this statement includes:

- ! The British Committee on Safety of Medicines convened a "Working Party on MMR Vaccine" to conduct an extensive review of several hundred cases reported to a group of solicitors as having developed autism or Crohn's (inflammatory bowel) disease as the result of immunization with the MMR vaccine. The Working Party concluded that the information available, given the limitations, "... did not support the suggested causal association or give cause for concern about the safety of MMR or MR vaccines."
- ! A recently published study in *The Lancet* by Dr. Brent Taylor and colleagues provides the best population-based evidence regarding MMR vaccination and autism. The authors identified all 498 known cases of autism spectrum disorders (ASD) in children living in certain districts of London who were born in 1979 or later and correlated the cases to an independent vaccination registry. The results of this study were:
  1. Despite an increase in the number of diagnosed ASD cases since 1979, no jump occurred after the introduction of the MMR vaccine in 1988. Such a jump would have been expected if MMR was causing a substantial increase in autism cases.

2. Children who were vaccinated before 18 months of age were diagnosed with autism at ages similar to children who were vaccinated after 18 months of age, indicating that the vaccination did not result in earlier expression of ASD characteristics. If MMR were causing many autism cases, it would have been expected that children vaccinated at a younger age would develop autism at a younger age than children vaccinated at older ages.
3. At age two, the MMR vaccination coverage among ASD cases was nearly identical to vaccination coverage of children in the same birth cohorts in the same London districts, providing evidence of a lack of overall association between ASD and the vaccination.
4. In general, the first diagnosis of autism or initial signs of behavioral regression were not more likely to occur within time periods following MMR vaccination than during other time periods.

A study conducted in Sweden by Gillberg and Heijbel, involved 55 known cases of autism, and also showed no evidence of association between the MMR vaccine and autism. The study compared autism prevalence rates in populations of children from two communities in Sweden. The results indicated no difference in autism prevalence between children born after the introduction of the MMR vaccine in Sweden and those born before the vaccine was used.

In summary, at this time, the weight-of-evidence does not support an association between the MMR vaccine and autism.

# Questions and Answers Regarding Vaccines and Autism

## *Autism*

### **1. What is autism?**

Autism is a term that refers to a collection of neurologically-based developmental disorders in which individuals have impairments in social interaction and communication skills, along with a tendency to have repetitive behaviors or interests. The severity of autism varies greatly, from individuals with little speech and poor daily living skills, to others who function well in most settings. Approximately 70-75 percent of individuals with autism also have mental retardation. Some adults with autism live independently.

### **2. What are autism spectrum disorders?**

Autism spectrum disorders (ASD) is a term used to describe the range of functioning among persons with autism. ASD includes the more specific diagnoses of autistic disorder, pervasive development disorder - not otherwise specified (PDD - NOS or atypical autism), and Asperger's disorder. ASD does not include the degenerative disorders of Rett's Disorder or Childhood Disintegrative Disorder.

### **3. How is autism diagnosed?**

Autism is typically diagnosed during the toddler or preschool years, although some children are diagnosed at older ages. Language delay or lack of appropriate social development may cause parents or teachers to seek an evaluation. Some children may have a period of normal development before the onset of symptoms and may even lose some earlier acquired skills, such as early words or social smiling. Currently, there is no blood test or other medical test available to diagnose autism. Correct diagnosis depends on extensive and accurate developmental history, as well as observations of the child's social, communicative, and play behaviors.

### **4. What is known about the prevalence of autism?**

The first epidemiologic study of autism was done in England in 1966 and found the autism rate to be 4-5 per 10,000 children in the general population. Other community studies published before 1985 that used similar diagnostic criteria yielded prevalence rates from 4-6 per 10,000. Studies published between 1985 and 1995 reported higher prevalence rates than studies published prior to 1985, with a mean of 11.8 per 10,000 children. A recent scientific review of studies on the prevalence suggested a conservative estimate for autism of 1 out of every 1000 children, with as many as 2-5 per 1000 persons



affected having some form of this disorder. There have been only two US population-based studies of autism. Both studies were conducted in the 1980s and yielded prevalence rates that are lower than most European studies, 3.3 and 1.0 per 10,000 children.

## **5. How many people in the United States have autism?**

Current figures for the prevalence of autism in the United States are not available. The most recent US figures for autism were obtained from two studies conducted in the mid-1980s which found low rates (1-3 per 10,000 children).

A number of studies from outside the US report rates suggesting a conservative estimate of the prevalence of 1 per 1,000 children, and there are a number of studies with higher rates. We need to do further studies to get a better understanding of the prevalence of autism, including the number of people with autism in the US.

## **6. Is the prevalence of autism increasing?**

We do not know if the autism rates are going up. The community-based studies published before 1985 found autism rates in the range of 4 to 6 in 10,000 children, using a narrow set of criteria. Studies published between 1985 and 1995 have reported rates as high as 12 per 10,000 children, but these studies used different criteria from the earlier studies, and were conducted outside the US.

Two studies of autism prevalence have been conducted in the US. Both were conducted before the 1980s using the narrow set of criteria similar to the earlier studies and found similar rates. Recent reports of autism prevalence in the US have used broader criteria and have shown an increase in the number of people seeking services.

CDC is not certain how much of the reported increase is due to changes in the definition of autism or improved recognition of this condition, as opposed to an actual increase in the number of children with autism. We also do not know if emerging environmental or lifestyle factors have contributed to the number of children seeking treatment. CDC proposes to establish standardized epidemiologic methods for beginning to monitor the prevalence of autism in the US.

## **7. I heard there was a State of California report that suggests that there is an increase in autism prevalence. Is that true?**

A 1999 report from the California Department of Developmental Services showed a 273% increase in the number of individuals receiving services for autism (1987-1998). For the same time period, the increase in services for all other developmental disabilities increased less than 50%. Special education services for children ages 6-17 years under the Individuals with Disabilities Education Act (IDEA), Part

B increased 556% (1991-1997). The California report documents that the number of people with autism who received services in California has increased four-fold over 11 years. While this increase in number of people being served is suggestive, there are a number of factors that can influence service provision, including better recognition of the condition and better services for children with autism. Also, these data are counts of people with autism, and not rates. We do know that the population in California has increased over time, resulting in more children in the California population with autism.

## **8. What is being done to determine how many individuals have autism?**

CDC is conducting several studies to examine the prevalence of autism. In 1998, autism spectrum disorders (autistic disorder, PDD-NOS, and Asperger disorder) was incorporated into CDC's Metropolitan Atlanta Developmental Disabilities Surveillance Program, which also conducts ongoing monitoring of the prevalence of selected developmental disabilities, mental retardation, cerebral palsy, vision impairment, and hearing impairment among school-age children. The results of the autism prevalence study are expected sometime in 2000. An investigation in Brick Township, New Jersey will determine the prevalence of ASD in 3-10 year old children in that area. CDC has funded Marshall University to begin a surveillance program for ASD in West Virginia.

## **9. What do we know about the causes of autism?**

The causes of autism remain unknown for most cases, but there are many studies that support a genetic contribution. Family studies have shed the most light on this issue. Studies of identical twins, who have the same genetic make-up, have found about a 75 percent concordance rate (both twins have autism); fraternal (non-identical) twins have a 3 percent concordance rate. The risk of autism in siblings ranges from 2 to 6 percent. Finally, among families with autism there is a 10 - 40 percent increase in the diagnosis of other developmental disabilities, such as language delays and learning disabilities. The inheritance pattern is complex and suggests that a number of different genes may be involved.

Autism also tends to occur more frequently than expected among individuals who have certain medical conditions, including Fragile X syndrome, tuberous sclerosis, congenital rubella syndrome, and untreated phenylketonuria (PKU).

Some harmful substances ingested during pregnancy also have been associated with an increased risk of autism, specifically, the prescription drug thalidomide. The Agency for Toxic Substances and Disease Registry (ATSDR) recently prepared a literature review of hazardous chemical exposures and autism and found no compelling evidence for an association; however, there was very limited research and more needs to be done.

## **10. What medications are available to treat autism?**

Currently, there are no medications specifically prescribed for autism. Some medications can relieve particular symptoms of the disorder, such as medications for sleep or to control undesirable behaviors, such as aggression or obsessive-compulsive behaviors. Use of medications should be discussed with your doctor.

## **11. Besides pharmaceutical treatments, what other treatments are available for autism?**

Research has suggested that early, intensive, behavioral interventions may improve outcomes for children with autism and help the children achieve their maximum potential. There are several different approaches that are offering promise in terms of improvement in functioning. (Examples are Lovaas, or ABA, and TEACCH)

## ***MMR Vaccine and Autism***

### **1. Does the MMR vaccine cause autism?**

CDC believes that the current scientific evidence does not support the hypothesis that MMR, or any combination of vaccines, cause the development of autism, including regressive forms of autism. A suspected link between MMR vaccine and autism has been suggested by researchers and some parents of children with autism. Often symptoms of autism are first noted by parents as their child begins to have difficulty with delays in speaking after age one. MMR vaccine is first given to children at 12 to 15 months of age. Therefore, children an apparent onset of autism within a few weeks after MMR vaccination may simply be an unrelated chance occurrence.

An extensive study of the evidence was recently conducted in the United Kingdom. The British Committee on Safety of Medicines convened a “Working Party on MMR Vaccine” to conduct a systematic review of reports of autism, gastrointestinal disease, and similar disorders after receipt of MMR or measles/rubella vaccine. The National Childhood Encephalopathy Study (NCES) was examined to see if there was any link between measles vaccine and neurological events. The researchers in England found no indication that measles vaccine contributes to the development of long-term neurological damage, including educational and behavioral deficits (Miller et al 1997). A more recent epidemiological study also found no association between MMR vaccine and autism (Taylor et al. 1999). This study compared rates of autism between children who received the MMR vaccine and children who did not. The results found no difference in rates of autism between the two groups.

## **2. What about the study by Dr. Andrew Wakefield, of the Royal Free Hospital in the United Kingdom?**

Current scientific evidence does not support the hypothesis that the MMR vaccine, or any combination of vaccines, causes the development of autism, including regressive forms of autism. This includes the research conducted by Dr. Wakefield.

### ***The Wakefield Study***

This study was conducted in 1998 and looked at whether the existence of the measles virus from the MMR vaccine could cause bowel disease and, in turn, cause autism. The authors reviewed reports of 12 children with bowel disease and regressive developmental disorders, mostly autism. In 9 of the cases, the child's parents or pediatrician speculated that the MMR vaccine had contributed to the behavioral problems of the children in the study.

This study was reviewed by an expert committee from the UK Medical Research Council (MRC). The Council concluded *there is no evidence to link the MMR vaccine with autism*. On April 3, 2000 the MRC issued a new report confirming its earlier conclusion; MMR has not been linked with inflammatory bowel disease in autism. A copy of this research report can be found in the appendix and is also available at the MRC web site, <http://www.mrc.ac.uk>

### ***Limitations of Dr. Wakefield's Study***

1. The study used too few cases to make any generalizations about the causes of autism; only 12 children were included in the study. Further, the cases were selected by researchers and may not be representative of many cases of autism.
2. There were inadequate groups of control children. As a result, it is difficult to determine whether the bowel changes were similar to changes in normal children, or to determine if the rate of vaccination in autistic children was higher than in the general population.
3. The study did not identify the time period during which the cases were identified.
4. In at least 4 of the 12 cases behavioral problems appeared before the onset of symptoms of bowel disease; that is, the effect preceded the proposed cause. It is unlikely, therefore, that bowel disease or the MMR vaccine triggered the autism.

## **3. Would it be safer to separate the MMR vaccine into its individual components—in other words, give children three separate shots, at different times (e.g., six months or one year apart), instead of one combined shot? Why do we have to use the combined vaccine?**

There is no scientific research or data to indicate that there is any benefit to separating the MMR vaccine into its individual components. This idea is not based on any published evaluation of the effect(s) it may have on children. In fact, splitting the MMR vaccine into three separate doses may be harmful because it would expose children unnecessarily to potentially serious diseases. For instance, if

rubella vaccine were delayed, 4 million children would be susceptible to rubella for an additional six to 12 months. This would potentially allow otherwise preventable cases of congenital rubella syndrome (CRS) to occur. Infection of pregnant woman with “wild” rubella virus is one of the few known causes of autism. Thus, by preventing infection of pregnant women, rubella vaccine also prevents autism.

#### **4. Should a younger sibling, or a child of someone who suffered autism be vaccinated with MMR or other vaccines?**

Current scientific evidence does not support the hypothesis that MMR, or any combination of vaccines, cause the development of autism, including regressive forms of autism.

While family history may need to be considered in specific circumstances, no contraindications to vaccination exist solely on this basis. Genetic susceptibility to severe events is worthy of further research. A younger sibling or the child of someone who suffered a vaccine adverse event usually can, and should, safely receive the same vaccine. This is especially true since the large majority of adverse events after vaccination are local reactions and fever, which do not represent a contraindication.

Due to the general safety of vaccines, and the rarity of serious vaccine adverse events, it is extremely difficult to study whether a subgroup (e.g., family members) are actually at increased risk compared with the general population. The one exception is an increased risk of neurologic events—primarily febrile seizures—after vaccination with DTP vaccine and measles-containing vaccines (MCV). The risk increases if any of these have previously occurred in immediate family members. Considering the rare occurrence of these events after DTP and MCV vaccination, the generally benign outcome of febrile convulsions, and the risk of pertussis and measles to unvaccinated people and the general population, the Advisory Committee on Immunization Practices concluded that a history of convulsions in siblings or parents should not be a contraindication to pertussis or measles vaccination. Special care in the prevention of post-vaccination fever may be warranted in children with a family history of seizures, however. Oral polio vaccine (OPV) is contraindicated when there is a family member with immune-deficiency since OPV can spread to family contacts.

#### **5. Should we delay vaccination until we know more about the negative effects of vaccines?**

There is no convincing evidence that vaccines such as MMR and hepatitis B cause long term health effects. On the other hand, we do know that people will become ill and some will die from the diseases these vaccines prevent. Discontinuing a vaccine program based on unproven theories would not be in anyone’s best interest. Isolated reports about these vaccines causing long term health problems may sound alarming at first. However, careful review of the science reveals that these reports are isolated and not confirmed by scientifically sound research. Detailed medical reviews of health effects reported after receipt of vaccines have often proven to be unrelated to vaccine but related to other health factors. Because these vaccines are recommended widely to protect the health of the public, research into any

theory about their safety is important to follow and further investigate. Several studies are currently underway to further investigate whether suggested long term effects are real or false signals.

## ***CDC's Autism Research Efforts***

### **1. What specific studies is CDC conducting about autism?**

CDC is currently conducting studies to furthering our understanding of the prevalence and causes of autism. The following are three examples.

**Autism Prevalence Study** - Beginning in 1998, autism was incorporated into the ongoing Atlanta-based developmental disabilities surveillance program. This is the first ongoing surveillance program for autism in the United States and will help CDC monitor changes in the rate over time.

**West Virginia** - In collaboration with the Marshall University Autism Training Center, the CDC is working to develop an autism surveillance program in several counties in West Virginia. In addition, CDC has awarded funds to Marshall University for development and implementation of an intervention project designed to reduce stress and secondary conditions in children who have autism and their families.

**Immunizations and Autism** - The National Immunization Program (NIP) and the Developmental Disabilities Branch of the CDC are conducting a study to examine whether the timing of vaccines administered before age 2 years differs in children with autism as compared with control children.

### **2. What research is CDC conducting on vaccination and autism?**

**Immunizations and Autism** - The National Center for Environmental Health and the National Immunization Program of CDC are conducting a study to examine whether the timing of vaccines administered before age 2 years differs in children with autism as compared with control children.

**Immunizations and Possible Developmental Regression** - CDC is working with the National Institutes of Health to conduct a study that will evaluate whether vaccination is linked with developmental regression, which occurs in a subset of children with autism.

**Inflammatory Bowel Disease and Mmr Vaccination** - CDC is using the Vaccine Safety Datalink in collaboration with several HMOs to study inflammatory bowel disease and MMR vaccination. Through these studies CDC is working to assure the safety of vaccination program and to identify preventable causes of autism.

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### **World Wide Web Resources:**

**NIH, National Institute of Child Health and Human Development:**  
<http://www.nichd.nih.gov/publications/pubs/autism2.htm>

**CDC, Division of Birth Defects, Child Development, and Disability and Health:**  
<http://www.cdc.gov/nceh/programs/cddh/dd/ddautism.htm>

**CDC, National Immunization Program:** <http://www.cdc.gov/nip>

## **Appendix**

Medical Research Council Media Release:

*No New Evidence of a Link Between MMR and Autism*